Note on an additional production schedule

Introduction

In preparation for the 1st May 2015, deliverables to the Ministry of Economic Affairs and the regulator (SodM), a number of production scenarios were presented. Additional to these scenarios a flat production schedule of 20 Bcm/year, starting in 2017, was used to test the different elements of the first fully probabilistic risk assessment.

On the 27th March 2015, NAM and SodM agreed to deliver a risk analysis for 4 chosen scenarios. This included 33 Bcm/year and 39.4 Bcm/year production scenarios, the immediate basis for the minister's decision on production levels for 2015, the original Winningsplan production scenario as a reference, and a 'bottom scenario' of 21 Bcm/year starting in the year 2020. This last scenario was designed to address the lower end of possible and workable outcomes ensuring security of supply in the Groningen gas market.

In this document, the results of the hazard and risk calculations for the additional theoretical 20 Bcm/year flat schedule are provided at the specific request of SodM in order to calibrate (or provide a comparison to) the results of the 'spoor 2' study work that SodM has undertaken in parallel to the NAM assessment. The rigorous quality control practices customary applied to the hazard and risk assessments, whereby two separate codes are used and results compared, has not been followed for this working test case.

As expected, the outcomes show a reduced hazard compared to the 33 Bcm/year scenario in the published Hazard Report. However in practice, this production schedule is not deemed operationally feasible and results are shared separate from the main Hazard Report (Ref. 1 and 2) for model calibration purposes only.

Gas production

For calibration of the hazard assessment methodology a theoretical production schedule was used.

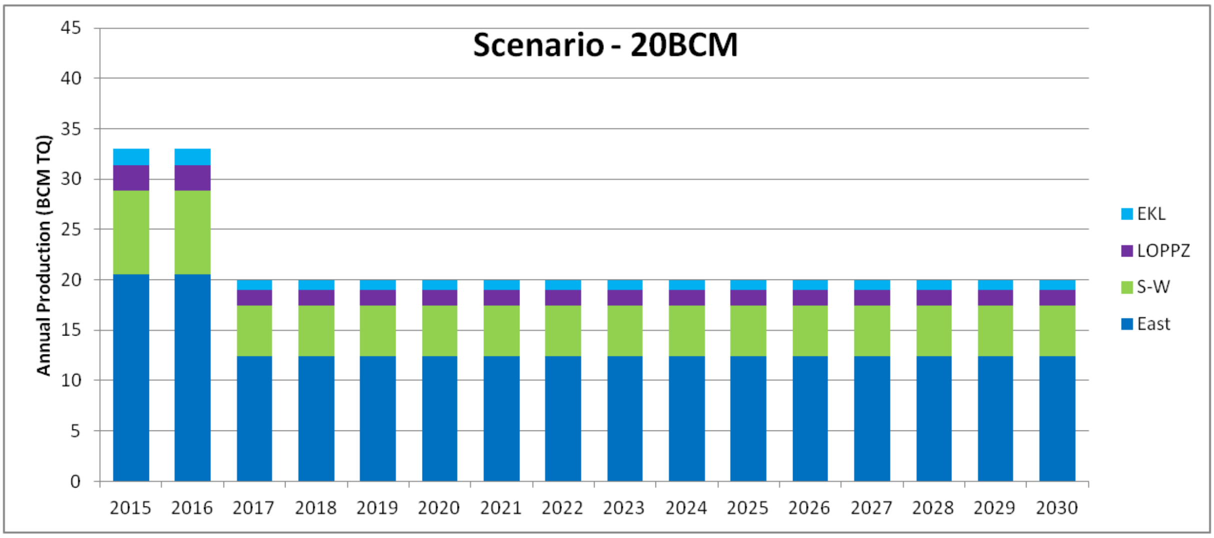


Figure 1 *An indicative gas production schedule for the theoretical production schedule. Production is kept below 20 Bcm/year, from 2017 onwards, until the natural decline of the production from the field sets in (which is later than 2030). No additional development wells are drilled.*

Hazard Assessment

Following the methodology described in the “Hazard and Risk Assessment for induced Seismicity Groningen – Study 1 - Hazard Assessment” (Ref. 1), a hazard map was prepared for this theoretical production schedule. In Figure 2 the hazard maps for the 39.4 Bcm/year and 33 Bcm/year production scenario are shown and compared with the theoretical production schedule of 20 Bcm/year.

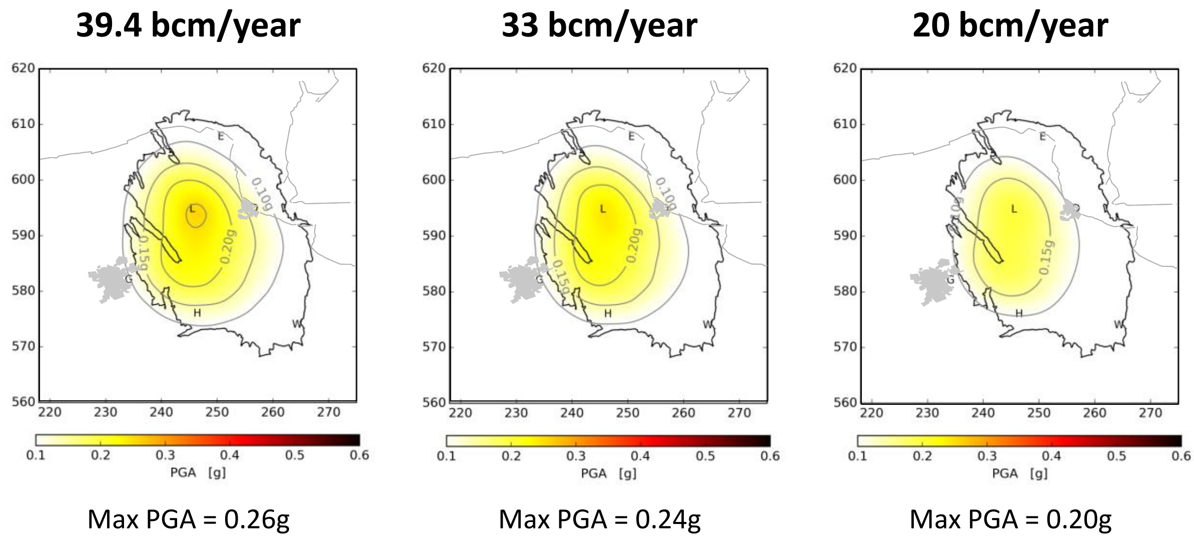


Figure 2 *Mean hazard maps for period 1-7-2016 – 1-7-2021, Production Scenarios: 39.4 Bcm/year and 33 Bcm/year are shown and compared with the theoretical production schedule of 20 Bcm/year. Compaction: Inversion - Linear, Activity Rate: V1, M ≥ 3.5 Metric: 0.2%/year chance of exceedance (10% chance in 50 years).*

The hazard map for the theoretical production schedule of 20 Bcm/year is also shown in figure 3.

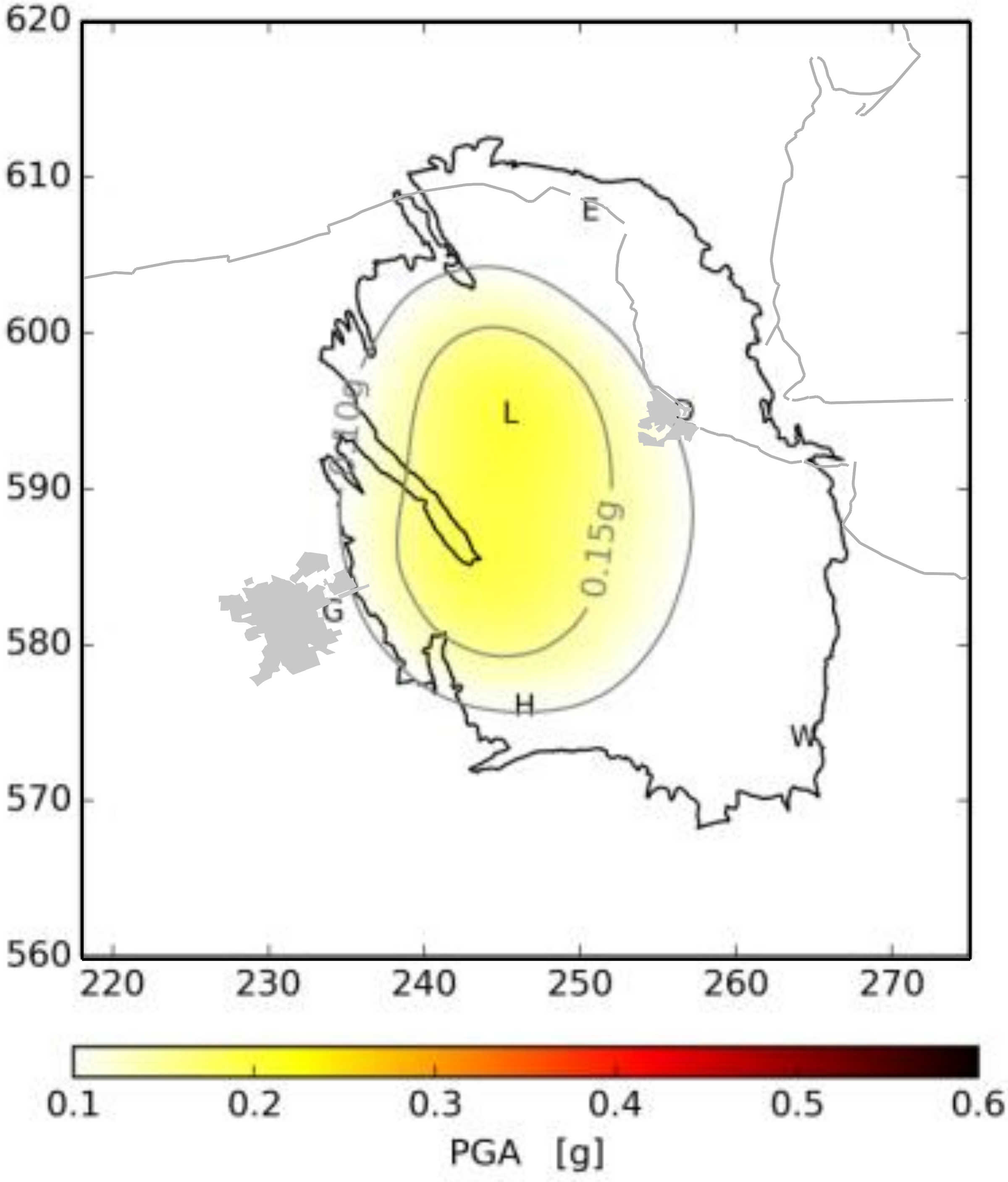


Figure 3 *Mean hazard map for period 1-7-2016 – 1-7-2021, Theoretical Production Schedule: 20 Bcm/year. Compaction: Inversion - Linear, Activity Rate: V1, M ≥ 3.5 Metric: 0.2%/year chance of exceedance (10% chance in 50 years).*

Risk Assessment

The risk impact of two groups of measures was discussed in the "Hazard and Risk Assessment for induced Seismicity Groningen – Study 2 - Risk Assessment" (Ref. 2); 1) production adjustments and 2) structural upgrading of the buildings in Groningen. Two production levels were considered in this report for the risk assessment: 39.4 Bcm/year and 33 Bcm/year, with and without the implementation of a structural upgrading plan. In Figure 4 shows the production scenarios with the additional theoretical production schedule.

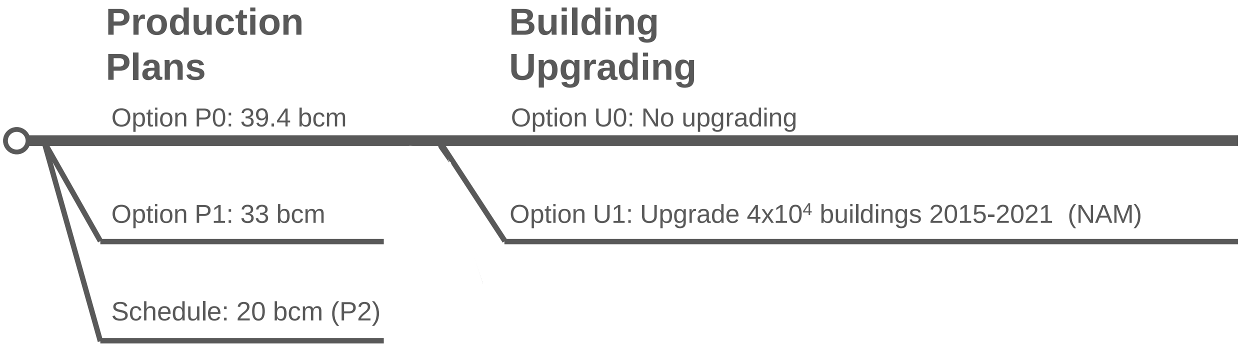


Figure 4 Summary of the mitigation measures and schedules considered in this risk assessment.

Figure 5 shows the impact of production scenarios and schedule on people exposed to ILPR.

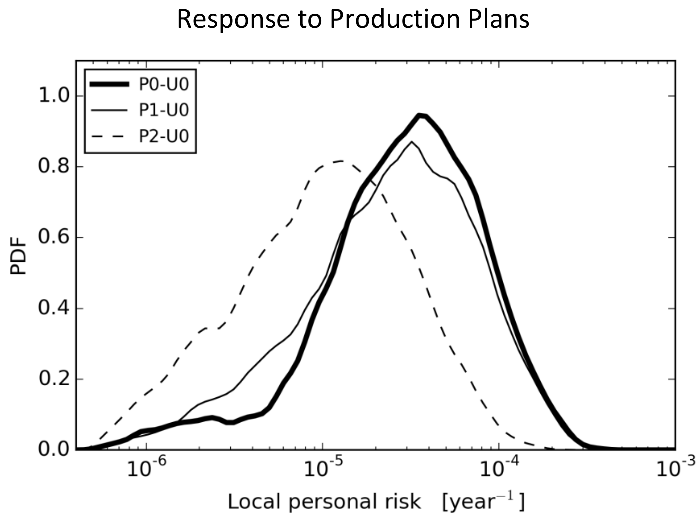


Figure 5 The assessed influence of risk mitigation measures on the probability density function (PDF) of local personal risk on a log-scale. (period: 1-7-2016 – 1-7-2021)

References

1. NAM, Hazard and Risk Assessment for Induced Seismicity Groningen - Study 1 Hazard Assessment, 26th May 2015.
2. NAM, Hazard and Risk Assessment for Induced Seismicity Groningen - Study 2 Risk Assessment, 26th May 2015.